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M.C.
Payette. - Plots 1, 2, 3.
Yellowpine.

Growth on Cut-over Western Yellow Pine Lands in Central Idaho

Carpenter Cr Plots.

By Clark Miles, Junior Forester.

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Purpose of Study.

Western Yellow Pine (Pinus ponderosa) is the most important commercial timber tree of the Payette, Boise, Weiser, and Salmon Forests of central Idaho. It is the most accessible, the most abundant and its lumber is of superior quality to that of any other commercial species in the region. It is estimated that there are 1,725,000 acres of Yellow Pine lands bearing 6,500,000 M feet B M of this species on these National Forests.

For the purpose of studying growth and methods of cutting on these lands, a series of 16 permanent sample plots were laid out on the Payette National Forest in 1913 and 1914. Only 3 of these plots have been cut-over and it is with these plots that this report deals. The primary purpose of this study is a growth study on cut-over lands to show what may be expected in the way of growth on lands cutover, in an attempt to arrive at definite conclusions as to length of cutting cycles , yields and rotation periods on working circles which are being established in this Yellow Pine belt.

General History and Description of the Plots.

The area covered by these 3 plots was cut over in 1913 and 1914. The plots were established and the first measurements taken about September 1, 1913. The plots were remeasured

about July 1, 1918 and the results published in a bulletin entitled "Growth on Cutover and Virgin Western Yellow Pine Lands in Central Idaho" by C F Korstian. They were again remeasured in March 1926, the results of which measurement are included in this report.

Plot 1, consists of a south and east aspect. See Figure 1. The soil is a porous, decomposed granite. Brush is negligible. Elevation is about 3700 feet.

Plot 2 consists of north slope largely, with a small portion of creek bottom and south slope. Brush is very heavy on the north slope. Soil is similar to that of Plot 1.

Plot 3 is located in a basin at the head of the creek. Soil is of granitic origin with a deposit of loam above. Brush is light. Eelvation of Plots 2 and 3 is about 3900 feet.

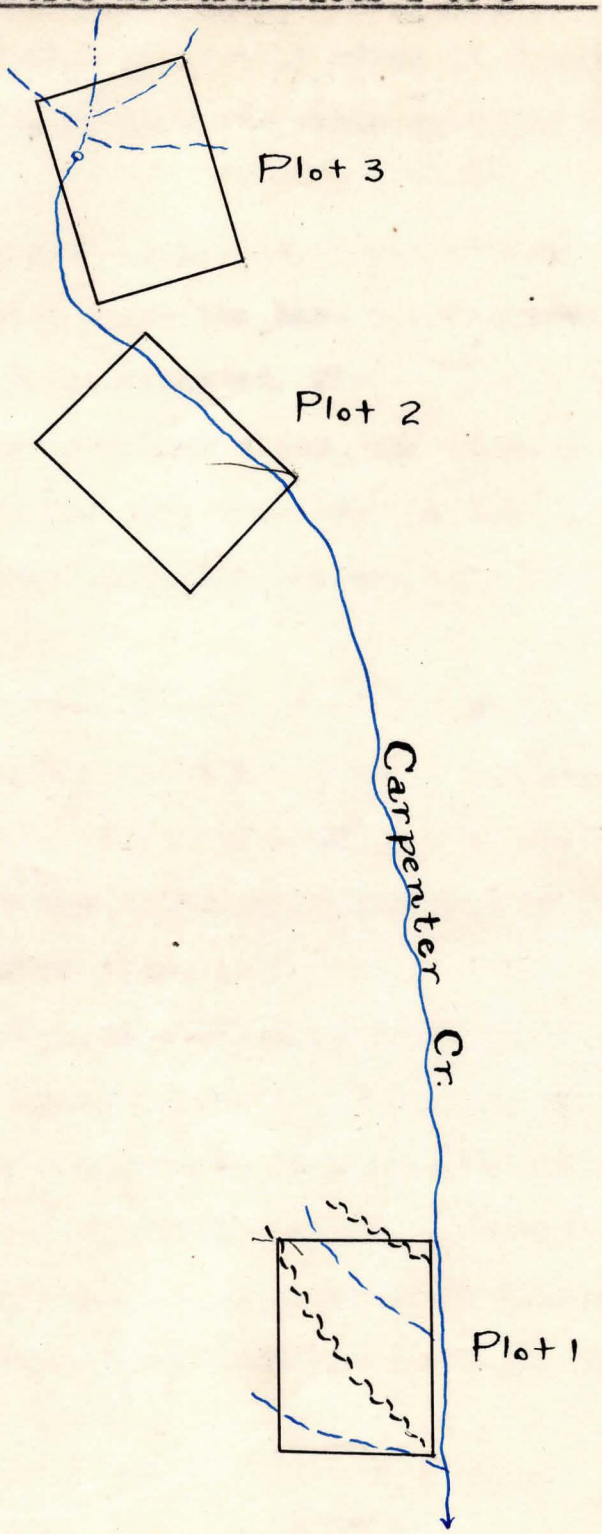
All three of these plots are of five acres each.

While the plots cover three different sites- north slope- south slope, and basin- it is probable from a study of Graph 1, that Plots 2 and 3 are Site II and Plot 1 is Site I according to present site classification which is based largely on height and age. Certainly Site III, which is represented by the Yellow Pine on open, exposed, high, granite ridges, which trees are usually large in diameter with short heights, is not represented.

Increase in Number of Trees

Table 1 gives the number of trees per acre at each successive measurement- 1913 to 1918 and 1918 to 1926.

Figure 1
Relative Location Plots 1 to 3



Yellow Pine habitually gorws in groups, and stocking is quite incomplete in spots while in other spots reproduction is crowded.

"New Trees" comprises, trees growing into the 4" dbh classification since the last measurement.

As is to be expected, Plot 3- basin type- shows the greatest number of new trees, the increase from 1913 to 1918 being 7.0 per acre and that from 1918 to 1926, 18.6 per acre- the original stand being but 8.6 per acre while the present stand is 33.8.

Plot 2 shows a loss in new trees between 1918 to 1926 as compared to 1913 to 1918. A heavy increase in numbers cannot be expected under the heavy brush prevailing on the north slope.

The average shows a net increase on all plots of almost 100% in numbers since 1913.

The age graph shows that trees of 4" dbh class are about 30 years of age at present. Therefore when cutting took place 12 years ago these trees were present and were about 15 to 18 years of age. This table shows quite strikingly the results which can be expected by increase in growing stock after cutting when advance reproduction is present and is protected during logging.

Losses.

Table 1 shows the losses in numbers. Heaviest losses have occured on Plot 1 where a total of 10 trees have died since the establishment of the plot.

Table 2 shows losses by causes and by volume.

Table 1.

Number of Living and Dead Trees per Acre

Plot	Aspect	No. in 1913	New Trees 1918	Losses 1918	No. in 1918	New Trees 1926	Losses 1926	No. in 1926	Species
1	south	28.2	4.4	.8	31.8	8.6	1.2	39.2	Y. P.
		.8	--	--	.8	--	--	.8	D. F.
	Total	29.0	4.4	.8	32.6	8.6	1.2	40.0	
2	north	6.0	2.6	.2	8.4	2.6	--	11.0	Y. P.
		4.6	2.0	--	6.6	.2	.2	6.6	D. F.
	Total	10.6	4.6	.2	15.0	2.8	.2	17.6	
3	basin	7.8	6.0	--	13.8	18.4	--	32.2	Y. P.
		.8	1.0	.2	1.6	.2	.2	1.6	D. F.
	Total	8.6	7.0	.2	15.4	18.6	.2	33.8	
				Average for all plots					
		14.0	4.3	.3	18.0	9.9	.4	27.5	Y. P.
		2.1	1.0	.1	3.0	.1	.1	3.0	D. F.
Average all species- all aspects		16.1	5.3	.4	21.0	10.0	.5	30.5	

Of the total loss of 14 trees with a volume of 4,192 bd ft a loss of 9% on the original volume and 0.9% on annual growth percent- 3,256 bd ft or 70% of the total loss was caused by a single colony of bark beetle (Dendroctonous brevicomis) in endemic stage. This colony has averaged about one tree per year since the area was cut. With but a single infestation in endemic stage causing a loss of 3,256 bd ft in 12 years on a 5-acre plot bearing but 24,365 bd ft originally or a loss of 14% on the original volume, the result would be quite startling should the attack become epidemic. This illustrates quite strikingly the fact that too little attention is paid to the damage resulting from insects. The field force should be taught to concentrate more of their small sale work on infested timber. To be concrete, the removal of a single tree at the right time of the yearwould have stopped this infestation and damage any year in the past 12 years.

The losses due to injuries sustained thru logging have entirely ceased.

Mistletoe damage is lacking.

Windfall is negligible. Several trees which were dead have been broken off by the wind, but there has been no windthrow in green timber since the area was cut over.

Fire damage was localized in one Douglas Fir which was so badly fire scarred by some fire at some remote period that it was greatly weakened and diseased and was broken off at a point about 20 feet from the ground by the wind.

Table 2

Loss in Volume per Acre- 1913 to 1926.

Cause	Yellow Pine			Douglas Fir			Total		
	No. Trees	cu ft	bd ft	No. Trees	cu ft	bd ft	No. Trees	cu ft	bd ft
fire damage	.1	2.4	8	.1	7.2	30	.2	9.6	38
insects	.5	35.9	217				.5	35.9	217
cut in trespass				.1	1.2	2	.1	1.2	2
logging injury	.1	5.7	22				.1	5.7	22
Total	.7	44.0	247	.2	8.4	32	.9	52.4	279
						per annum	.1	4.4	23

There is a slight amount of damage from porcupine work, porcupines having killed the tips of some six or eight trees. These trees were young and small and the loss is due to loss in volume due to the tree forming forks. There have been no trees killed by porcupines girdling them.

Increase in volume.

Table 3 shows increment on these plots, both on a cubic foot and on a board foot basis.

The table shows the greatest gross growth percent on Plot 3- the basin plot- as is to be expected- followed by the south slope and the north slope plots. This holds ~~ture~~ true for both Yellow Pine and Douglas Fir.

The table shows that on these cut-over areas which averaged 584,5 cubic feet per acre left after cutting, a 5.5% gross increment for the first 5 years after cutting, with an increase for the next 7 years, resulting in a 5.6% gross for the entire 12 year period. Computing on a board foot basis- based on trees 8" dbh and larger" a volume of 3,000 feet per acre left after cutting, put on 7.3% gross or 6.4 % net growth for the 12 year period. Assuming that we have more or less insect damage which is uncontrollable, resulting in the damage thruout the working circle as given above and assuming a 50 year cutting cycle, with an average stand left per acre of 4M feet- 6.4% increments for 50 years amounts to a total of 16,800 feet per acre, which with a cut of 75% of the total amounts to a cut of 12,600 feet per acre. Areas now being cut over in the Cascade Working Circle have netted a cut of 11,950 per acre

Table 3

1. Increment of trees 4" and over dbh- Cubic feet.

Plot		Vol per A first measurement (1913)	Vol per A third measurement (1926)			Annual Increment per A 1913-'26		Growth 1913-18		Percent 1913-26	
			Gross	Loss	Net	Gross	Net	Gross	Net	Gross	Net
1 south	YP	942.0	1518.0	120.1	1397.9	48.0	38.0	5.0	4.8	5.1	4.0
	DF	26.6	53.7	--	53.7	2.3	2.3			8.6	8.6
	Total	968.6	1571.7	120.1	1451.6	50.3	40.3			5.2	4.2
2 north	YP	235.9	365.3	11.0	354.3	10.8	9.9	6.4	5.4	4.6	4.2
	DF	108.9	194.1	22.0	172.1	7.1	5.3			6.5	5.0
	Total	344.8	559.4	33.0	526.4	17.9	15.2			5.2	4.4
3 basin	YP	424.6	787.3	--	787.3	30.2	30.2	6.3	6.3	7.1	7.1
	DF	15.5	39.5	3.7	35.8	2.0	1.7			13.0	11.0
	Total	440.1	826.8	3.7	823.1	32.2	31.9			7.3	7.3
			Average all plots								
	YP	534.2	890.2	43.7	846.5	29.7	26.0	5.5	5.3	5.6	5.0
	DF	50.3	95.8	8.6	87.2	3.8	3.1			7.5	6.0
Total		584.5	986.0	52.3	933.7	33.5	29.1			5.8	5.0

2. Increment of trees 8" and over dbh- Board feet.

1 south	YP	4780	8675	679	7996	325	268			6.8	5.6
	DF	93	210	--	210	10	10			10.8	10.8
	Total	4873	8885	679	8206	335	278			6.9	5.7
2 north	YP	1228	2238	58	2180	84	79			6.9	6.4
	DF	311	635	191	544	27	20			8.7	6.4
	Total	1539	2873	149	2724	111	99			7.2	6.4
3 basin	YP	2352	4561	--	4561	184	184			7.9	7.9
	DF	39	103	6	97	5	5			13.0	13.0
	Total	2391	4664	6	4658	189	189			7.9	7.9
			Average all plots								
	YP	2787	5158	246	4912	198	177			7.1	6.4
	DF	148	316	32	284	14	12			9.5	8.1
Total		2935	5474	278	5196	212	189			7.3	6.4

with 4,010 feet left, or 74% of the total being cut. This would mean an operation in 50 years of the same magnitude as the present operation, and that our 50 year cutting cycle assumption is entirely feasible and amplee

However, do out figures show that the growth precent will be maintained for 50 years? Table 3 showed a slight increase in g gross growth for the second period as over the first period, or that the growth percent is increasing as time goes on. Table 1, also, showed new, rapid-growing trees coming in at the rate of 100% increase in numbers in 12 years. However, the question arises as to the effect crowding will have on the growth as the trees grow larger. Graph 2 shows that diameter growth is practically constant regardless of size or age, up to about a 37" dbh tree of about 240 years of age (See Hodson's Graph 6). In other words, in 12 years a 6 inch tree has grown to a 9 inch and a 26 inch tree has grown to a 29 inch and similarly thruout. The graph is practically a straight line up to a limit well beyond that size which will be striven for when under mangagement. This is largely for the reason that the trees which are left after cutting are all thrifty growing trees. As indicated by the graph it is reasonable to assume that a tree which grows from 6 to 9 inches dbh in 12 years will grow from 9 to 12 the next 12 years and to a total of 18 inches dbh in 50 years- wxcept for loss due to suppression. The bulk of the growth which is cut at the second cut in 50 years is in the larger sizes which should be thinned if occurring in suppressed groups at the first

If properly thinned in marking there should be little loss thru suppression and any such loss should be offset, if not more than offset by the material coming into sawlog size from the smaller sizes.

If the growth-in-dbh graph is a straight line is not volume growth a constantly accelerated quantity? Graph 3 shows why such is not the case. Height growth from about 6" dbh or 40 year age to 20" dbh or 120 year age is practically uniform, after which it tapers off rapidly.

This results as shown in Graphs 4, 5 and 5a, of a practically uniform volume growth from 4 to 16" dbh or 0 to 100 years of age, with a much greater rate of growth from 16 to 20" dbh or 100 to 120 year age class. Above 20" dbh the rate of growth drops off. It would therefore, seem that the rotation period should be 120 years. Technically this is the case. Practically it is probable that the increase is stumpage resulting from higher grades derived by holding the material for larger sizes than 20" dbh, would more than offset the loss in volume.

Marking Yellow Pine

From the above study it seems that the present marking rules in vogue are substantially correct. There are several points which might well be emphasized, however, as follows:

1. Protect advance reproduction to the fullest extent possible.

2. Thin crowded or suppressed groups of trees 10" and

larger in dbh.

3. Leave for future growth, only thrifty growing trees- leaving avoid trees showing a tendency to form flat tops. when in doubt use the increment borer.

4. Windfall needs little consideration in this region.

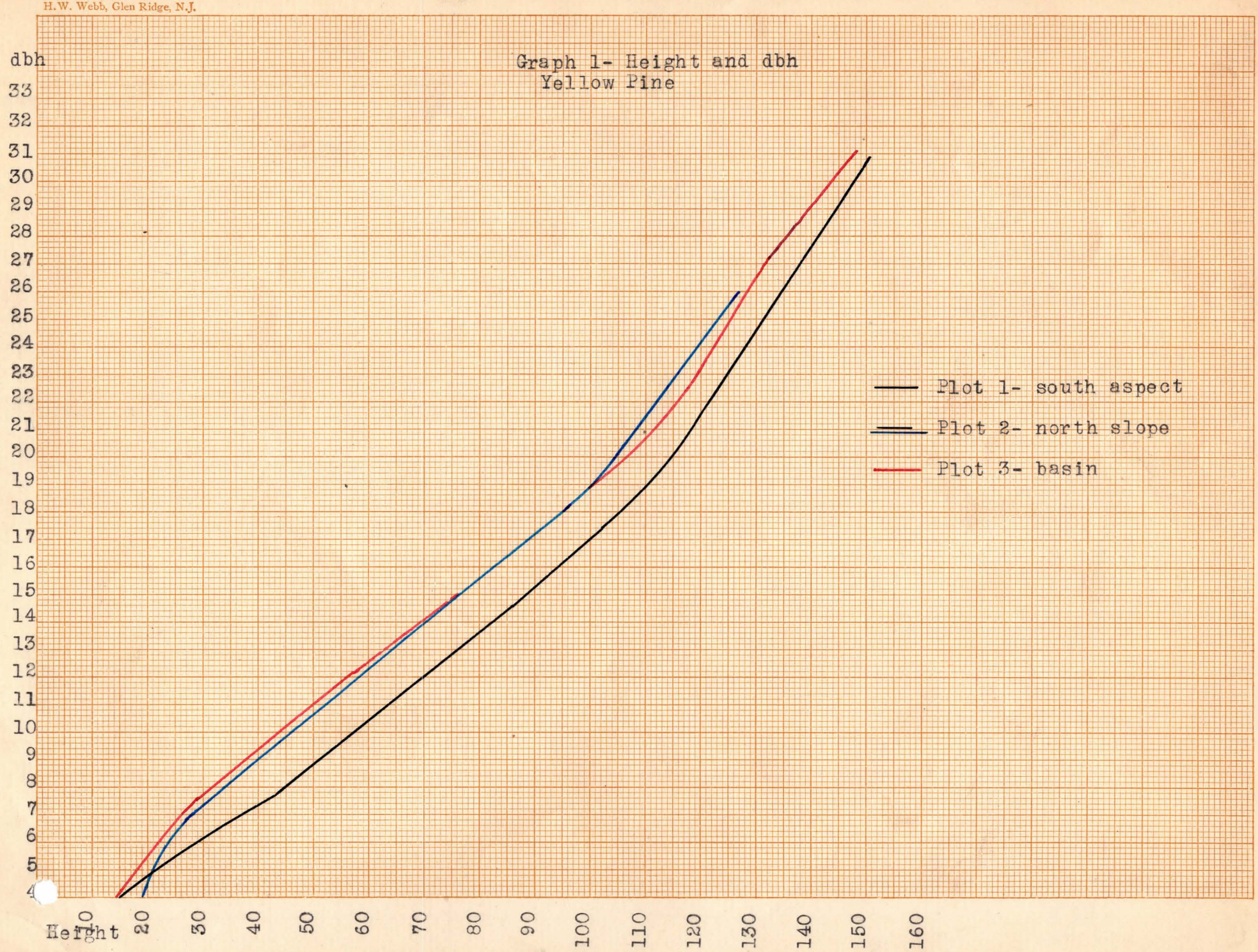
5. Losses thru insect depredations need more consideration than has been given in the past. Bark beetle work is controllable to a large extent. Timber should be closely observed for evidence of infestation and the trees marked if infested regardless of age or condition. The local force should be instructed in the importance of securing cutting of infested trees where possible thru free use, etc.

Summary.

This study has concerned itself only with the growth and results of marking on cutover areas. A study of virgin forest as compared with cutover lands has been made and the results summarized in the bulletin heretofore mentioned.

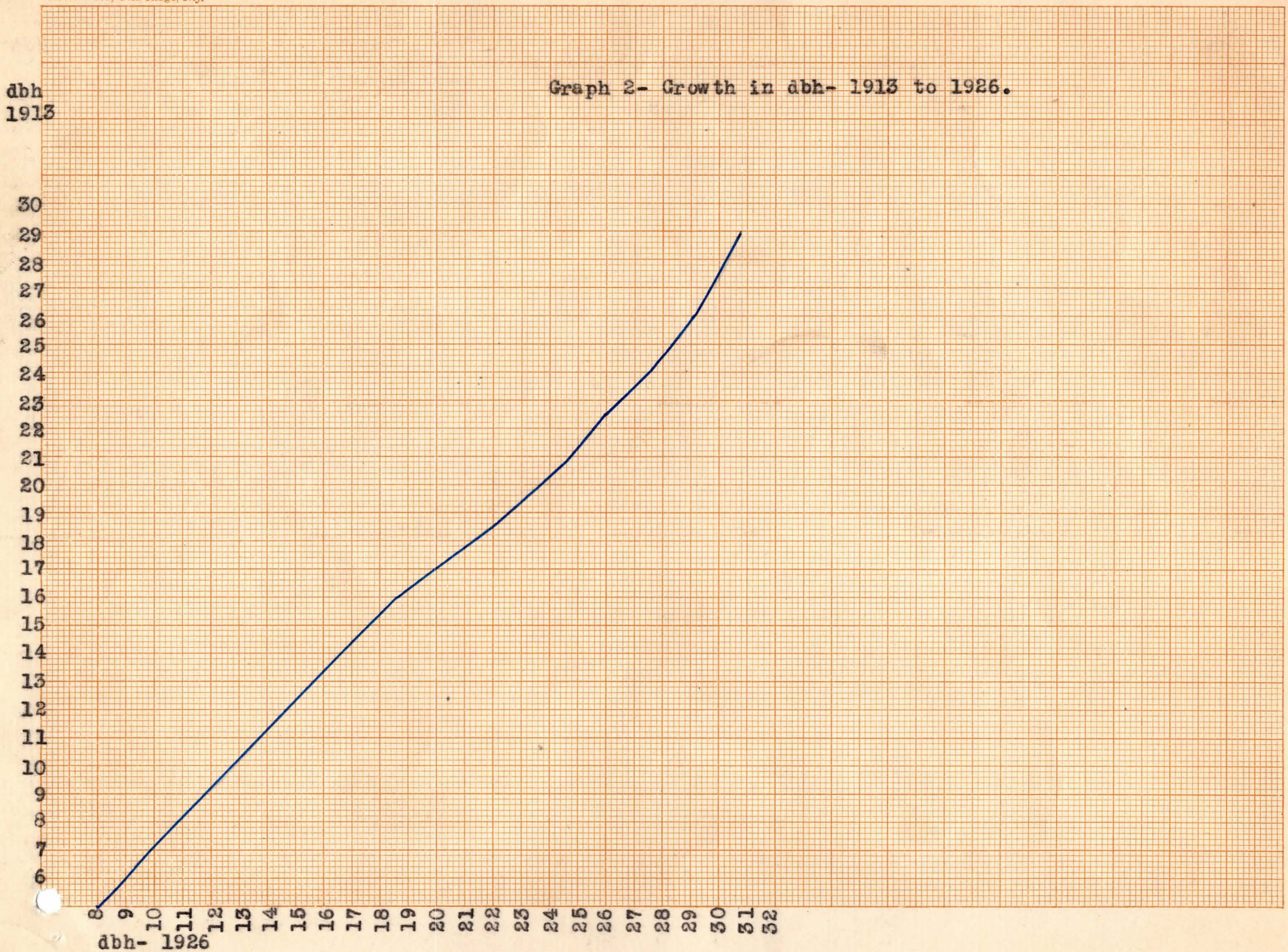
It is believed the study has shown that our marking rules for Western Yellow Pine are correct in principle and that a little more emphasis is needed on certain of the rules; that 50 year cutting cycles will give a second cut in 50 years of the same magnitude as the present one; and that 120 years appears to be the technical rotation period.

H.W. Webb, Glen Ridge, N.J.



H.W. Webb, Glen Ridge, N.J.

Graph 2- Growth in dbh- 1913 to 1926.



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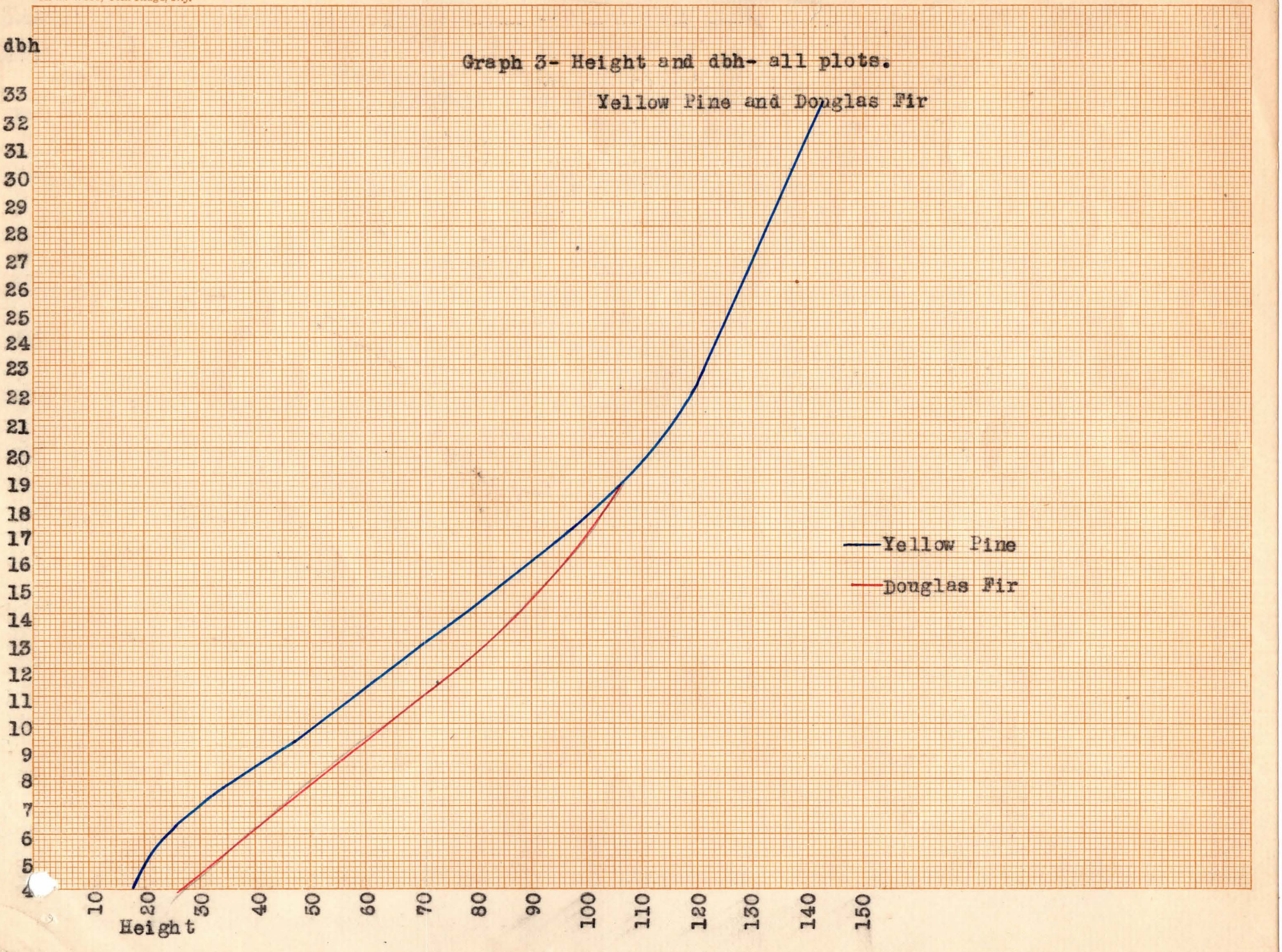

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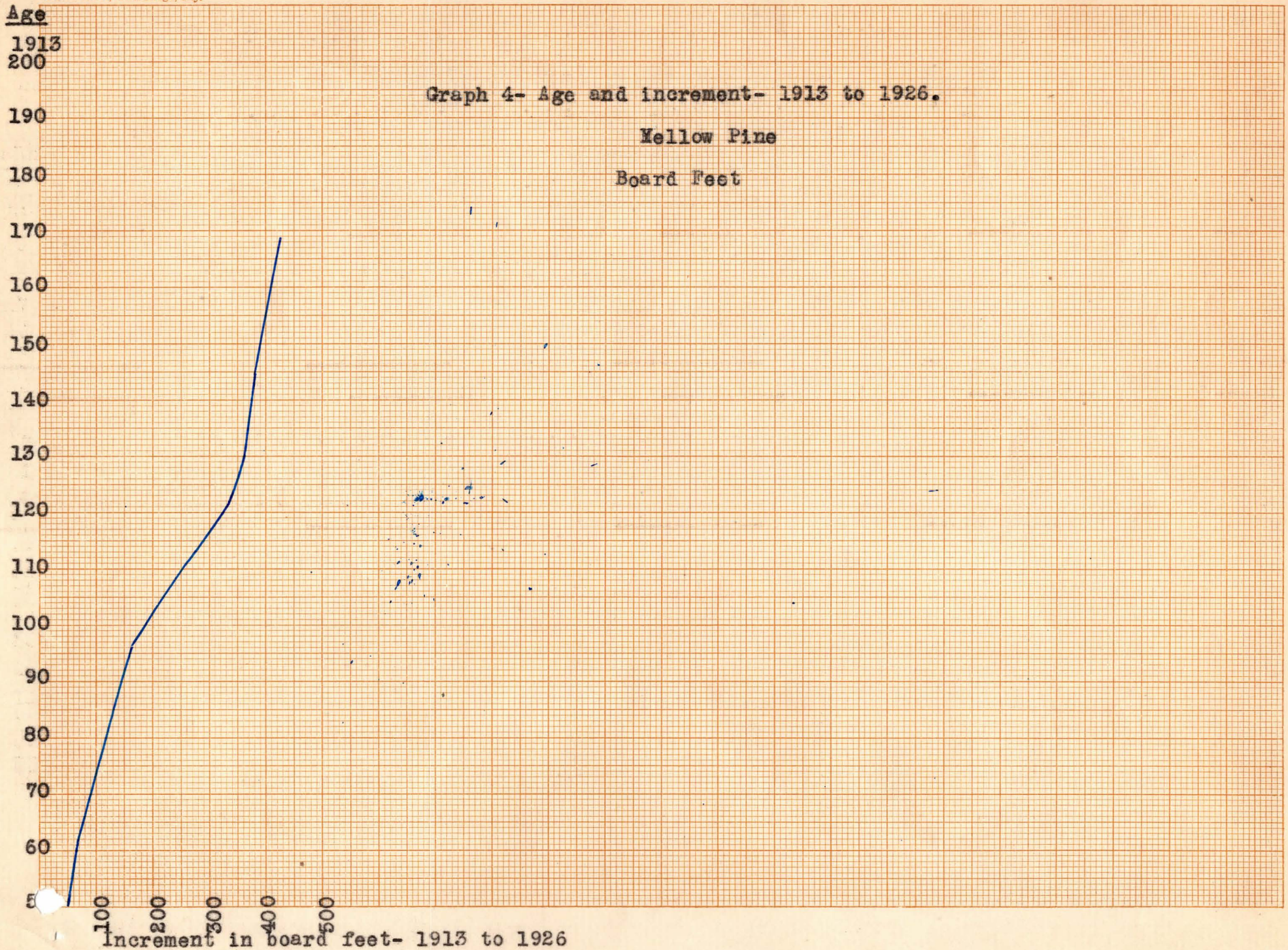


Graph 4- Age and increment- 1913 to 1926.

Mellow Pine

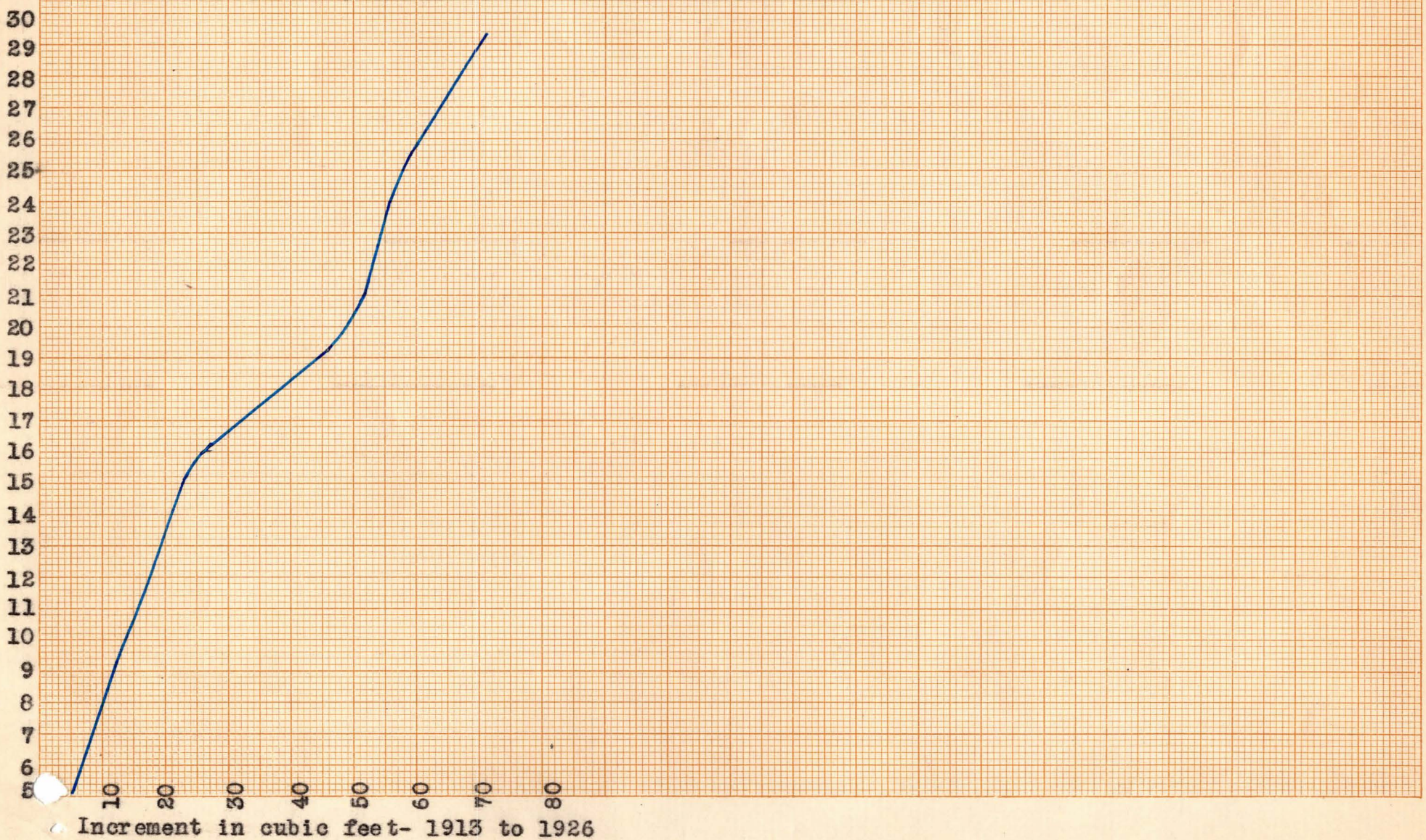
Board Feet

H.W. Webb, Glen Ridge, N.J.

Graph 5a- Increment and dbh- 1913 to 1926

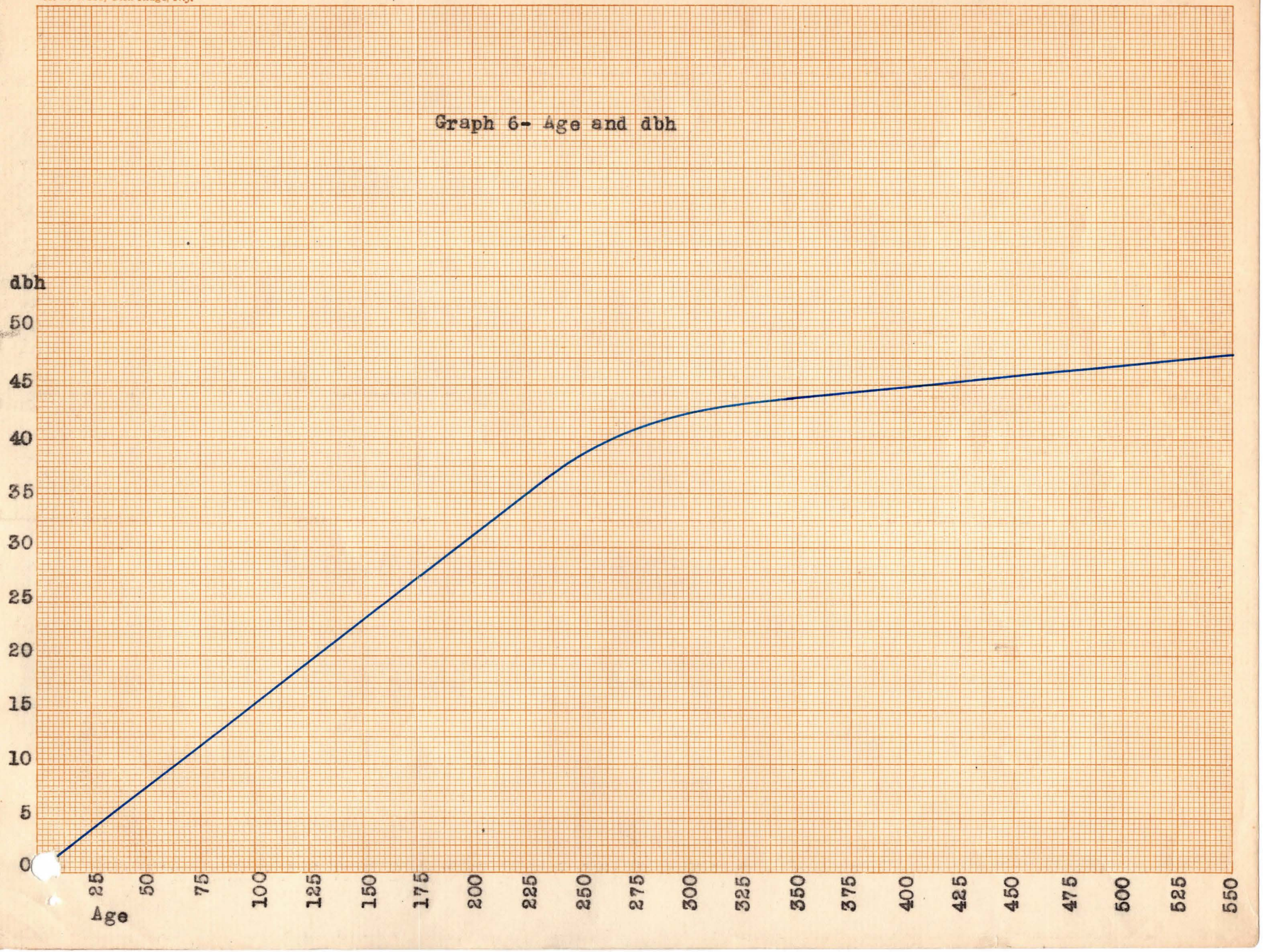
Yellow Pine

Cubic Feet.



H.W. Webb, Glen Ridge, N.J.

Graph 6- Age and dbh



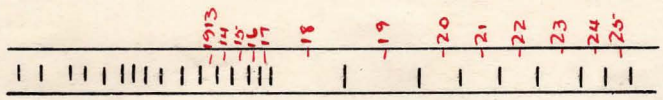
Average heights and cubic foot and board foot volume Yellow Pine and Douglas Fir.

Yellow Pine				Douglas Fir			
dbh	height	cu. ft.	bd. ft.	dbh	height	cu. ft.	bd. ft.
4	18	.6		4	26	1.3	
5	20	1.1		5	32	2.3	
6	24	1.7		6	38	3.8	
7	29	2.7		7	45	6.3	
8	36	4.4	7	8	51	10.2	6
9	44	6.7	15	9	57	14.8	24
10	52	9.7	29	10	63	19.4	44
11	58	13.2	47	11	70	26.0	72
12	64	17.0	70	12	75	32.7	100
13	71	22.4	100	13	81	40.6	143
14	78	29.0	136	14	86	48.9	179
15	85	36.5	185	15	91	58.3	221
16	91	44.6	233	16	96	68.6	274
17	97	54.2	288	17	100	79.5	320
18	102	64.4	350	18	105	92.7	375
19	107	75.3	425	19	109	106.8	445
20	112	87.8	502				
21	115	100.0	585				
22	118	112.8	674				
23	121	127.2	767				
24	124	141.8	872				
25	126	156.8	974				
26	128	173.0	1082				
27	130	189.0	1200				
28	132	207.4	1334				
29 30	137	249.0	1621				
31	139	270.0	1776				
32	141	292.3	1936				
33	143	316.2	2111				

Figure 2.

Full-size Measurements Taken from Borings from Representative Black-jacks Released by Cutting.

No. 1



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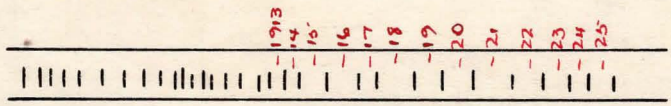

Tree No. 1- In 1913 a 14" tree 78 feet high
In 1926 a 19.9" tree 104 feet high

Tree No. 2- In 1913 a 14" tree 78 feet high
In 1926 a 19.1" tree 104 feet high

From Plot 1.